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ABSTRACT

This study examined the effectiveness of a conceptual change teaching strategy over the traditional method on high school students' (N=152) attitudes towards learning biology. The study employed a two-group experimental control design. The experimental group was taught using a conceptual change teaching strategy. A 21-item instrument that is validated and based on a three-point scale was administered to the students. Analysis of the students' post-instructional attitude towards the strategy suggests that there is a significant difference in the attitude of students in the two classes after the treatment. The U-test value of the groups was significant and led to the rejection of the only hypothesis. Contains 24 references. (Author/DDR)

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ABSTRACT

The Effect of a Conceptual Change Teaching Strategy (Model) on Students Attitude Towards the Learning of Some Biology Concepts.

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The present study examined the effectiveness of the conceptual change teaching strategy over the traditional method on 152 high school students attitude towards learning some biology concepts.

The simple two group-experimental control design of Rose & Smith 1971 was chosen for the research. The experimental group was taught using the conceptual change teaching strategy adopted from Driver (1980) which was withheld from the control group taught with the traditional method. A 21-item instrument (Pre and Post Instructional Attitude Test PIAQ I & II) validated and based on 3 point scale was administered to the students.

Analysis of the students post instructional attitude towards the strategy employed suggest that there was a significant difference in the attitude of students in the two classes after treatment. The U-test value of the groups was significant which led to the rejection of the only hypothesis.

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INTRODUCTION

Students attitude towards any object (subject) has been described as a function of their belief about the object (subject) and the implicit evaluative responses with those beliefs. (Fishbein & Ajzen 1975). Also various researches (Brown & Story 1979, Fraser et al 1983, Weinburgh 1995) had emphasised that students attitude exert a significant influence on their learning and the teaching strategies used can also influence the attitudes positively or negatively towards the subject.

As regards science, Simpson and Oliver (1985) ascertained that favourable attitude generally account for between 20%-25% of the variation in academic achievement. But although students differ in degree of their attitudes towards different subject taught in the school curriculum, a person would generally perform better in any discipline to which he is favourably disposed.

Brown and Storey (1979); May and McMillan (1979), in their different studies found that students using activity oriented techniques exhibited more favourable attitudes towards science than those taught using conventional (traditional) method and that teachers personality and interrelationships are very crucial in the attitude formation of students. When science educators teach with this perception, the attitude students need in order to benefit from the teaching of science could be developed.

In fact some researches had also suggested that students attitude, motivation and perception of self and of the science classroom can help explain differences in achievement. (Centra and Potter 1980; Wilson 1980; Fleming and Malone 1983; Stein Kamp and Mahehr 1983. Wilson 1983; Napier and Riley 1985; Talton & Simpson 1986). A challenge to science educators therefore is how to design classroom instruction that will effectively address the individual student needs.

The instructional strategy used in this present study is similar to that of Hewson and Hewson (1983). The design permit greater student involvement in the teaching - learning process in a classroom. Also the teaching strategy diagnoses students preconceptions in order to incorporate the elements that are associated with conceptual change. This approach to teaching is employed not only to facilitate learning but also to build up favourable attitude towards science. When students are helped to make the leap after a meaningful learning of concepts they not only achieve better cognitively, they can also retain and exhibit favourable attitude towards science. These approaches are generally not provided in typical traditional classroom or are in sharp contrast to traditional approaches that often start from Facts and concepts outside the child's range of experiences (Prawat 1992). For the current educational practice does not provide for an effective adaptive instruction.

Duschell et al (1991) have suggested that when teachers have philosophical and psychological models for selection and sequencing of instructional task, they would be able to prescribe a more effective or meaningful learning strategies.

The present study therefore examined the effectiveness of the conceptual change teaching strategy over the traditional method on 152 high school students attitude towards learning some biology concepts.

Research Design and Instrument

The simple two group (Experimental and Control) design of Rose and Smith (1971) was chosen for the research. The Experimental group was taught using the conceptual change teaching strategy which was withheld from the control group taught using the conventional (traditional) way.

A 21-item instrument (Pre and Post Instructional Attitude Test PIAQ I & II) validated and based on 3 point scale - Agree, Undecided, Disagree with numerical values 3, 1, 2 (for positive responses) and 2, 1, 3 for negative responses was administered to the students. The Pre and Post test was to identify students attitude towards biology as a course before and after the instructional strategy.

Procedure

The topics selected were Nutrition and cellular Respiration in plants. These topics were selected because they have not been taught to the students though part of the scheme of work.

The teaching model for conceptual change of Driver 1980 was Adopted with a slight modification after being validated by members of a panel.

Driver model consisted of these operations orientation, elicitation for ideas, Restructuring of Ideas, Clarification and Exchange, Exposure of Conflict situations, Construction of New Ideas, Evaluation, Application of Ideas, Review Change in Ideas and Comparison with Previous Ideas.

The modified version has the first and the second operation merged under one heading that is orientation and elicitation of ideas since they compliment each other. Also the eighth and nineth have been subsumed under the seventh operation which is evaluation.

The CCTM model is chosen for the experimental group since it took a constructivist view of science learning.

i) <u>Orientation and Elicitation of Ideas</u>
This involves certain activities intended to arouse Students interest in the topics to be taught. The students spent time reviewing their own ideas or conception of the topics. Then the class was split into four groups and each group represented their ideas on a poster as concept maps and this was placed on the wall. By this, their pre-instructional ideas of the target concepts was identified.

ii) <u>The Restructuring Phase</u>
At this stage, the lesson sequence which gave students opportunities to try out their preconceptions was presented. This involves practical construction tasks.

iii) <u>Clarification and Exchange</u>
At the end of the lesson sequence, students in the experimental class were given the opportunity to review the extent and ways in which their ideas have changed.

iv) Construction of New Ideas
The concept maps were modified and new ones constructed and compared with earlier ones.

v) Evaluation
This evaluated the effectiveness of the experimental strategy of learning scientific concepts.

vi) Comparison with Previous Ideas
This involves comparing the old ideas (Pre-Instructional Ideas) with the new (Post-Instructional Ideas). This provided an indicator of the effectiveness of the strategy of instruction.

The traditional teaching of the scientific concepts was done through providing theoretical facts by telling, demonstrating and using chalk board to the controlled group. Students copied notes and referred to textbook sources for further information and were evaluated at the end of the lesson. All the experiments carried out for this group were through demonstration method. The pre-test was administered to both group in the first week and the post test after the treatment of six weeks.

Results

To test the only hypothesis that there is no significant difference between the attitude of students towards the teaching of biology concepts using the conceptual change teaching strategy and the traditional methodology, the frequencies of students responses to the attitudinal statements before (Pre-Instruction) and after treatment (Post-Instruction) were determined. These values were used in Mann-Whitney U-test statistics at 0.05 level of significance.

Table I
Experimental versus control Group Analysis (Pre-Instruction)

Groups	*No in Group*	*Mean Rank*	*Cases/Scale*
Experiment	76	30.3	3
Control	76	2.9	3

Calculated U value = 2; Z score = 0.04, P value = 0.02

From the above table, the U calculated value is 2 with a P value of 0.02. The 2 score was less than one. Both values of 2 scores and P value are lower than 0.05 chosen level of significance. Therefore before the treatment, there was no significant difference in the attitude of the students to biology as a course of study.

However, table II shows the comparison after the treatment.

Table II
Experimental versus control Group Analysis (Post Instruction)

Groups	*No in Group*	*Mean Rank*	*Cases/Scale*
Experiment	76	33.3	3
Control	76	3.67	3

Calculated U value = 4.0; Z score = 0.21, P value = 0.83

From table II, the calculated U Value is 4.0 with a P value of 0.83. The Z score (a standard normal deviate) was less than 1.

Both the P value and Z score are higher than the critical values at $P \leq 0.05$. Hence the only hypothesis is rejected. For there is a significant difference in student attitude towards biology as a course after instruction using the conceptual change teaching model (CCTM) and traditional method.

Results from this study revealed a positive change in attitude towards the CCTM. For it is evidenced that the traditional teaching strategies had limited success in bringing about conceptual change in the students. But teachers employing this traditional strategy seemed to be unaware of the tenacity with which students hold on to their own conceptions concerning the subject taught. This could be resistant to change via the traditional instructional approaches. (Clement 1982; Halloune and Hesterel 1985; Anderson and Smith 1987; Gunstone, Champagne and Klopper 1981; Linn and Barbulus 1988).

In a typical CCTM classroom, students are seen interacting with themselves and the instructional materials which make them more involved in the teaching-learning process opposed to the traditional method where the students are passive listeners. This CCTM model with consequences of knowledge restructuring was directed to the experimental class. The detected impact of the very short instruction with this group of students is educationally very significant and encouraging and has important implication for curriculum designers. For Nwagwu (1976) asserted that attitude must be learnt and may be modified later by re-education.

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